REMARKS

Reconsideration of this application is respectfully requested in view of the foregoing amendment and the following remarks.

Applicant has amended Claims 57 in a manner believed to overcome the rejection under 35 USC § 112. Favorable reconsideration is respectfully solicited.

Claims 21, 30-40, 44-47, 50-56 and 60-80 stand rejected under 35 USC § 102(b) as being anticipated by Germanton et al., No. 5,014,793. In addition, Claims 22-29, 41-43, 48, 49 and 57-59 stand rejected under 35 USC § 103 as being unpatentable over Germanton et al. Applicant respectfully traverses these rejections.

The Germanton reference is directed to a variable speed controller for a dc powered tool that includes what is known in the art as an "electronic clutch". In particular, electric drills and power screw drivers typically include mechanical clutch assemblies that are connected between the gear train, which is driven by the output of the motor, and the output spindle of the tool. These mechanical clutch assemblies are usually provided with an adjustment ring which the operator uses to select the desired maximum torque to be applied to the output spindle and hence to the fastener. When the selected torque level is attained, the mechanical clutch assembly uncouples the output spindle from the gear train to interrupt the application of torque to the output spindle. An example of a power tool with a mechanical clutch assembly of this type is shown, for example, in U.S. Patent No. 4,159,050.

As noted in the Background section of the Germanton reference, there are a number of disadvantages with mechanical clutch assemblies. Accordingly, it is the principal object of the Germanton patent to eliminate the mechanical clutch assembly

and instead provide a variable speed DC controller that includes circuit means for electronically clutching the output spindle of the tool.

Toward this end, the Germanton power tool includes a torque control switch 13 for selectively setting the desired torque output of the tool (See col, 6, lines 307). The actual torque output of the tool is determined by monitoring the current through the motor which is proportional to the torque exerted on the driven tool bit (col. 7, lines 34-38). This is achieved through the use of a current sensing resistor (43 in Fig. 2 and 163 in Fig. 3) that is connected between the motor control FET (41 is Fig. 2 and 160 in Fig. 3) and ground. The desired torque signal (as determined by the setting of switch 13) is then compared to the actual torque output of the tool (as determined by the signal from current sense 43/163) by a comparator circuit (current overload torque reference 40 in Fig. 2; comparator 208 in Fig. 3). When the desired torque is exceeded by the actual torque, the comparator 208 provides an output signal that biases the motor control FET (41/160) OFF, thereby interrupting power to the motor. (See col. 11, lines 65-68). Thus, the torque control circuitry in the Germanton patent "electronically decouples" the motor from the output spindle of the tool when the desired or selected torque level is achieved.

The "second" switch 17 in the Germanton reference functions as a conventional variable speed trigger switch. The only difference is that the switch 17 in the Germanton patent is described as a "zero displacement" switch, rather than a traditional retractable trigger switch, and as such has no moving parts. Instead, the switch 17 has associated therewith a strain gage sensor array that senses the pressure applied to the switch by the user and varies accordingly the voltage of the output signal from the

sensor array. (See col. 6, line 55-61). This voltage signal is applied through a soft start circuit (34 in Fig. 2; components 70, 71 and 72 in Fig. 3), to a pulse width modulator circuit (36) which produces a PWM output signal whose duty cycle is proportional to the magnitude of the voltage signal from the pressure sensor array (col. 9, lines 6-13). Note that the frequency of operation of the PWM circuit is determined by the values of resistors 106, 107 and 110 and capacitor 111 (col. 8, line 68 to col. 9, line 3) which are fixed. Consequently, there is no way to vary the frequency of the PWM signal without physically changing the values of these components.

The PWM control signal is applied (via "logic circuit 39") to the gate of the FET (41/160) to control the speed of the motor. (Col. 11, lines 53-59). Note, that "logic circuit 39" is nothing more than the circuit node (unnumbered in Fig. 3) connecting the output from NAND gate 124 with the output from comparator 208, which is in turn connected to the gate of FET 160. Thus, when the output of the comparator 208 goes LO when the actual torque level exceeds the desired torque setting, the PWM control signal coming from NAND gate 124 is grounded and the FET 160 is turned OFF, thereby interrupting power to the motor.

Thus, there is absolutely nothing in the Germanton patent to suggest the variable speed control circuitry disclosed therein is anything more than a conventional PWM variable speed controller. In short, there is nothing in the Germanton reference to suggest that the frequency of the PWM controller is set to such a very low frequency (resulting in the individual pulses in the PWM control signal being spaced so far apart in time) that the motor ratchets rather than turns smoothly, so that the output spindle of the tool rotates in a discontinuous incremental fashion. Moreover, there is nothing in

Germanton to suggest that the controller is designed to change its operating mode in response to a monitored operating characteristic of the tool, other than to simply interrupt power to the motor when the selected torque level is attained.

Accordingly, it is respectfully submitted that the Examiner's assertion in paragraph 4 of the Office Action that the controller in Germanton controls the "PWM signal in response to a change in the [monitored] operating characteristic [of the tool] <u>to thereby cause the power tool to operate in pulses</u>" (emphasis added), is not correct. Rather, the controller in Germanton <u>interrupts</u> power to the motor in response to a change in the monitored operating characteristic of the tool. In addition, the further statement by the Examiner that the second switch 17 in Germanton causes discontinuous incremental rotation of the output spindle", is also not correct. As discussed above, there is nothing in Germanton to suggest that the variable speed controller operates the motor in other than a smooth continuous manner.

Moreover, Applicant completely disagrees with the Examiner's assertion in paragraph 6 of the Office Action that the PWM frequency range of less than 50 Hz is obvious and merely the selection of "an optimum value" of a variable. Conventional variable speed PWM control circuits are designed to provide smooth motor operation throughout the speed range of the motor. Thus, if Applicant were claiming a particular high frequency value which achieved "optimum" smooth performance for a particular motor design, the Examiner's statement would have merit. In the present case, however, the claimed frequency range causes dramatically different operational results which are completely contrary to the design intent of known PWM controllers. Accordingly, the claimed frequency range is anything but obvious from the cited art, and

has nothing to do with any intent to "optimize" the normal operation of a conventional variable speed controller.

Therefore, the present claims are believed to clearly define patentable subject matter over the cited art. Favorable reconsideration is respectfully solicited.

Respectfully submitted,

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